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EXPERIMENTAL INVESTIGATION OF IMPROVING IODINE REMOVAL EFFICIENCY FOR SELF-PRIMING VENTURI SCRUBBER

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ABSTRACT

In Nuclear Power Plant (NPP), it is necessary to remove particulate matter and gaseous pollutants from gas stream before releasing into atmosphere during abnormal conditions such as severe accidents. There are many efforts have been made in past to remove pollutants. In view of environmental aspects and stringent regulation of nuclear safety, this paper presents experimental investigation on performance of venturi scrubber. The experimentation is carried out in submerged condition. The venturi scrubber has been designed, developed and fabricated for experimental analysis to study iodine removal efficiency in self-priming mode. The investigation consists of contamination of air by mixing iodine vapours using pressure cooker and suction venturi system. Contaminated air is used to evaluate performance of venturi scrubber. The water is used as scrubbing fluid. Iodine removal efficiency is considered as one of the important performance parameters of venturi and it is determined experimentally with variable pH of scrubbing fluid and iodine inlet concentration. Iodometric titration is used to find iodine amount in scrubbing fluid. It has been found that pH of water improves performance efficiency of venturi. It is observed that iodine is more soluble at higher values of pH and performance efficiency of venturi gets improved with increase in pH of water. Performance efficiency is also improved with an increase in iodine inlet concentration. The liquid to gas ratio (L/G ratio) is one of the important parameters of iodine removal efficiency of venturi scrubber. This has been also observed that liquid L/G ratio increases with increase in water column of primary tank due to increase in hydrostatic pressure of water column at throat of venturi scrubber.

KEYWORDS: Contaminated Air, Scrubbing Fluid, L/G Ratio, NPP, Primary Tank & Suction Venturi

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Original Article

1. INTRODUCTION

Particulate matter and gaseous pollutants emitted by many industries and power plants, are the major global concerns due to its undesirable and ill effects. Nuclear emissions with iodine (I-131) as a major constituent are released into the containment from the molten core due to accidental failure of nuclear power plant. These fission products are highly radioactive and cause adverse effects on environment and human health when they are released into atmosphere [1]. Radioactive iodine I-131 increases the risk of thyroid cancer due to its accumulation in the thyroid gland via contaminated air or water [2]. The ionising radiations emitted from nuclear power plant increase the risk of lung, bone and colorectal cancer [3]. In view of reducing pollutants in the environment the venturi is installed in NPP to mitigate the radioactive effects [4]. There are many designs of filtered containment venting system that have been reported in the literature [5].

A venturi scrubber is used to eliminate various contaminants from contaminated fluid before released in to environment. Convergent, a throat and a diffuser are main parts of a venturi scrubber. Convergent part of venturi scrubber accelerates the atomization of water. The scrubbing fluid interacts with gas in throat. The velocity of gas decelerates in diffuser which allows some pressure recovery. In this experimentation, contaminated air has been scrubbed by using fabricated venturi and contaminated air has been obtained by mixing of iodine vapours in air. The schematic diagram of venturi scrubber is as shown in Figure1a and it is manufactured by using acrylic material and Figure1b depicts manufactured venturi of acrylic material. This present research elaborates literature review, experimental set up and performance of venturi scrubber.

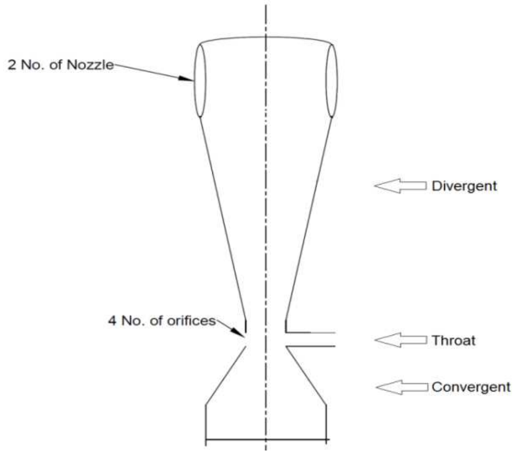

Figure 1a: Venturi.

Figure 1b: Fabricated Venturi.

2. LITERATURE REVIEW

Venturi scrubber is important device for scientists and engineers since many years back to eliminate contaminants from contaminated fluid. Johnstone et al. [6] found that they could effectively use the venturi configuration to remove particles from gas streams. Ekman and Johnstone carried out study and found that the collection efficiency of venturi scrubber depends upon operating conditions and nature of aerosol.

The literature review comprises study of pressure variation, droplets size, particle collection efficiency, liquid to gas ratio and iodine removal efficiency, and these are discussed as follows.

2.1 Pressure Drop

The pressure drop is related to air flowing through a venturi and it includes friction loss and acceleration loss [7]. Geometry of the scrubber influences loss due to friction and in most cases the acceleration losses can be predicted theoretically. The several theoretical and experimental models are developed and presented in literature to predict pressure drop. Calvert [8] and Boll [9] presented numerical models for pressure drop. The mathematical model developed by Boll and according to his model pressure drop is occurred due to acceleration of air, acceleration of the droplets and friction.

The experimental correlations are developed by Yamauchi [10], Matrozoy et al. [11], Volgin et al. [12], Gleason et al. [13], and Hesketh [14]. The theoretical correlations are further proposed by Yoshida et al. [15], Calvert [8] [20], Tohata et al. [16], Boll [9] and Behie and Beeckmans [17]. The equation of motion and mass balance is used to derive theoretical equations. Geiseke's [18] and Boll's equation are similar and Boll had neglected mass transfer between the phases. Pressure drop correlations developed by various investigators are given in table 1.

Table 1: Pressure drop correlations [19]

Researcher	Mathematical Equations
Matrozov	$\Delta P = \Delta P_D + 1.38\times10^{-3}\times u_{GT}^{1.08}\left(\frac{Q_L}{Q_G}\right)^{0.63}$
Yoshida et al.	$\Delta P = \frac{\rho_G u_{GT}^2}{2\times g_c}\left(a + b\frac{Q_L}{Q_G}\right)$ $a = \frac{f_C}{\delta \tan\frac{\theta_1}{2}} + 4f_T\frac{l_T}{d_T} + \tau\left(1 - 2\frac{d_T^2}{d_0^2}\right)$ $b = (\xi_T - 1)\frac{4f_T l_T}{\rho_m d_T} + (\xi_{DS} - 1)\frac{\tau}{\rho_m}\left(1 - \frac{d_T^2}{d_0^2}\right)$
Yamauchi et al.	$\Delta P = 0.3(\Delta T)^{-0.28}\times\frac{\rho_G u_{GT}^2}{2\times g_c}\left(1 + \frac{Q_L}{Q_G}\right)$
Tohata et al.	$\Delta P = \frac{\rho_G u_{GT}^2}{2\times g_c}\left\{1 - \left(\frac{A_T}{A_{DS}}\right)^2\left[\frac{f_C}{\delta\ \tan\theta_1} + \frac{f_{DS}}{\delta\ \tan\theta_2}\right] + \tau_1 + \tau_2 + f_T\frac{l_T}{d_T}\right\}$
Geiseke	$\Delta P = \frac{76}{g_c S_\varepsilon}\left[m_G\Delta u_G + m_L\Delta u_L + \frac{\Delta m_L}{2}\left(u_{G_1} + u_{G_2} - u_{L_1} - u_{L_2}\right)\right]$
Volgin et al.	$\Delta P = 3.32\times10^{-6}\times u_{GT}^2\left(\frac{Q_L}{Q_G}\right)^{0.26}(l_T)^{1.43}$
Calvert	$\Delta P = 1.03\times10^{-3}\times u_{GT}^2\left(\frac{Q_L}{Q_G}\right)$
Gleason et al.	$\Delta P = 2.08\times10^{-5}\times u_{GT}^2(0.264\times Q_L + 73.8)$
Boll	$\Delta P_{loss} = \beta\rho_L\left(\frac{Q_L}{Q_G}\right)u_{GT}^2$
Behie and Beeckman	$\Delta P = -\left(\frac{6F}{\pi d_d \rho_d}\right)\left[\frac{1}{2}C_D\rho_G(u_G - u_d)^2\times\frac{\pi d_d^2}{4}\right]dt$
Hesketh	$\Delta P = 1.36\times10^{-4}\times u_{GT}^2\rho_G A_T^{0.133}\left[0.56 + 935\left(\frac{Q_L}{Q_G}\right) + 1.29\times10^{-5}\left(\frac{Q_L}{Q_G}\right)^2\right]$

This has been observed from literature that pressure variation is very much important performance parameter of venturi and optimum pressure drop at throat of venturi is very much essential for self-priming of venturi scrubber.

2.2 Particle Collection Efficiency

Particle collection efficiency in venturi is dependent upon several processes like condensation, inertial impaction, diffusion, interception, nucleation, nucleation and growth. The contribution of processes depends on droplet, relative velocity of droplet and size of particle. Particle collection efficiency is based upon gas velocity, L/G ratio, particle size and size distribution etc. The "Scrubber Handbook" by Calvert, et al. [20] explains various collection processes such as collection by cylinders, bubbles, drops, liquid jets and aerosol accumulation in ducts and pipes. [21]. Collection by drops is important process observing predominantly in venturi scrubber. Boll [9] numerically determined collection efficiency and he had considered drag coefficient and geometry effect.

Taheri and Sheih [22] developed a three dimensional model for collection efficiency considering droplet concentration distribution. According to researchers' particle collection for particles having diameter greater than 0.5 µm is occurred due to inertial impaction [21]. An inertial impaction depends on change in velocity between particles in gas and gas itself. The literature is available on scrubber performance with respect to pressure drop, throat area and liquid to gas

ratio. Hesketh [14] specified that the collection efficiency depends on pressure drop, throat area and L/G ratio. Cooper and Leith [23] explained geometry effect, throat velocity and size of particle to evaluate optimum performance of venturi. Pulley [24] explained liquid injection method and evaluate the performance of two different venturi scrubber considering collection efficiency. Monabbati et al. [25] specified the mathematical model to determine the collection efficiency of venturi. Mayinger and Lehner [26] presented different operating conditions and performance of venturi. Based on literature, it is understood that particle collection efficiency is very important parameter for the performance of venturi scrubber and it depends upon different operating conditions and height of water column in primary tank. The operating conditions are gas flow rate, liquid flow rate and number of orifices used at throat of venturi.

2.3 Liquid Drop Size

The droplet size affects collection efficiency of particle and liquid drops are responsible for particle collection in venturi. Several correlations are available with various operating parameters and fluid properties like surface tension, viscosity and [19] and some of them are given in Table 2. Nukiyama and Tansawa [27], specified the mean droplet diameter for standard air and water in venturi scrubber. Parker and Cheong [28] considered wetted approach to give drop size in a venturi and technique used to measure drop size was similar to that of Nukiyama and Tanasawa. Roberts and Hill [29] predicted droplet size via photography by using Nukiyama and Tanasawa correlation. Fernandez et al. [30] noticed drop size variations across the throat of venturi. He also specified that the size distribution shifts towards the bigger size and becoming wider as drops proceed along venturi. Silva et al. [31] specified that the droplet size is controlled by turbulent breakup and coalescence mechanism and he noticed that decrease in droplet size along throat at constant gas velocity.

Table 2: Average liquid drop size correlations [19]

Researchers	Correlations
Nukiyama & Tanawa	$d_d = \frac{58{,}600}{u_G}\left(\frac{\sigma}{\rho_L}\right)^{0.5} + 597\left(\frac{u_L}{(\sigma\rho_L)^{0.5}}\right)^{0.45}\left(1000\frac{Q_L}{Q_G}\right)^{1.5}$
Mugele	$\frac{d_d}{d_n} = A(N_{Re})^B\left(\frac{u_L u_r}{\sigma}\right)^C$ $(A, B, C\ are\ constants)$
Gretzinger & Marshall	$d_m = 0.26\left[\frac{m_L}{m_G}N_{ReG}\right]^{0.4}$
Kim & Marshall	$d_m = 0.512\frac{\sigma^{0.41}u_L{}^{0.32}}{(u_G^2\rho_G)^{0.57}A^{0.36}\rho_L{}^{0.16}} + 1.89\left(\frac{u_L^2}{\rho_L\sigma}\right)^{0.17}\frac{\left(\frac{m_G}{m_L}\right)^n}{u_G^{0.54}}$ n= $-1\ for\ \frac{m_G}{m_L} < 3$ n= $-0.5\ for\ \frac{m_G}{m_L} > 3$ $d_d = \frac{58{,}600}{u_G}\left(\frac{\sigma}{\rho_L}\right)^{0.5} + 597\left(\frac{u_L}{(\sigma\rho_L)^{0.5}}\right)^{0.45}\left(1000\frac{Q_L}{Q_G}\right)^{1.5}$

From literature, it is found that the liquid droplets and its size are important for venturi performance.

2.4 Iodine Removal Efficiency

Majid Ali et al. [32] [33] investigated the iodine removal efficiency in non-submerged and submerged venturi without using any external prime mover to operate venturi. Gulhane et al. [19] experimentally investigated performance of a submerged venturi scrubber and noticed following observation:

- Venturi scrubber eliminates the iodine more efficiently with exceeding pH of water.

Iodine elimination is one of the important performance parameters of venturi scrubber and experimental investigation of it is necessary. This experimental iodine removal efficiency will help to decide optimum design of venturi scrubber.

3. EXPERIMENATATION: IODINE REMOVAL PROCESS IN VENTURI

Mechanism of Inertial impaction is a prime focus in this experimentation since iodine removal process is influenced by it and the study is carried with this mechanism.

Figure 2 depicts the iodine elimination process in venturi by scrubbing. Air with high speed enters at throat resulting entry of scrubbing water in throat. This process will be carried out without using any external prime movers and it happens due to pressure variation. This pressure variation is created due to static pressure of contaminated air and hydrostatic pressure of scrubbing fluid in primary tank. These interactions in between air and water cause atomization of liquid, resulting formation of very small drops. These drops move along with contaminated air and intermingle with iodine contaminants existing in it resulting collection of iodine particles and clean air is released into environment.

Figure 2: (a) Venturi in liquid (b) Atomization of liquid (c) Solubility of Iodine in water

4. EXPERIMENTAL SETUP

Figure 3 represents the investigational arrangement for the performance analysis of venturi in terms of iodine removal efficiency. Three stage compressor is used to compress the air. The compressor has operated to get compressed air in the range of 6 - 8 bar for experimentation with variable conditions like gas flow rate and air pressure at venturi inlet. A compressor provides the compressed air and pressure regulator is connected next to the compressor to adjust the required pressure in the experimentation. A globe valve is connected in between pressure regulator and rotameter to control volumetric flow rate of air. Rotameter is connected after globe valve to measure the volumetric flow rate of air. In an experimental set up, suction venturi is located to suck iodine vapours and pressure cooker is attached to suction venturi for

sublimation of iodine flakes into iodine vapours. A pressure gauge is located prior to venturi scrubber to measure pressure at entrance of venturi. Bypass valve is connected in connection line for contamination of air with effective mixing of iodine vapours. Needle valve is used in connection line and iodine vapours are controlled by it. A venturi scrubber is located inside the primary tank to remove iodine by scrubbing contaminated air. This venturi scrubber is completely submerged in water and water is used as scrubbing fluid inside the primary tank.

Figure 3: Experimental setup for performance Investigation of venture.

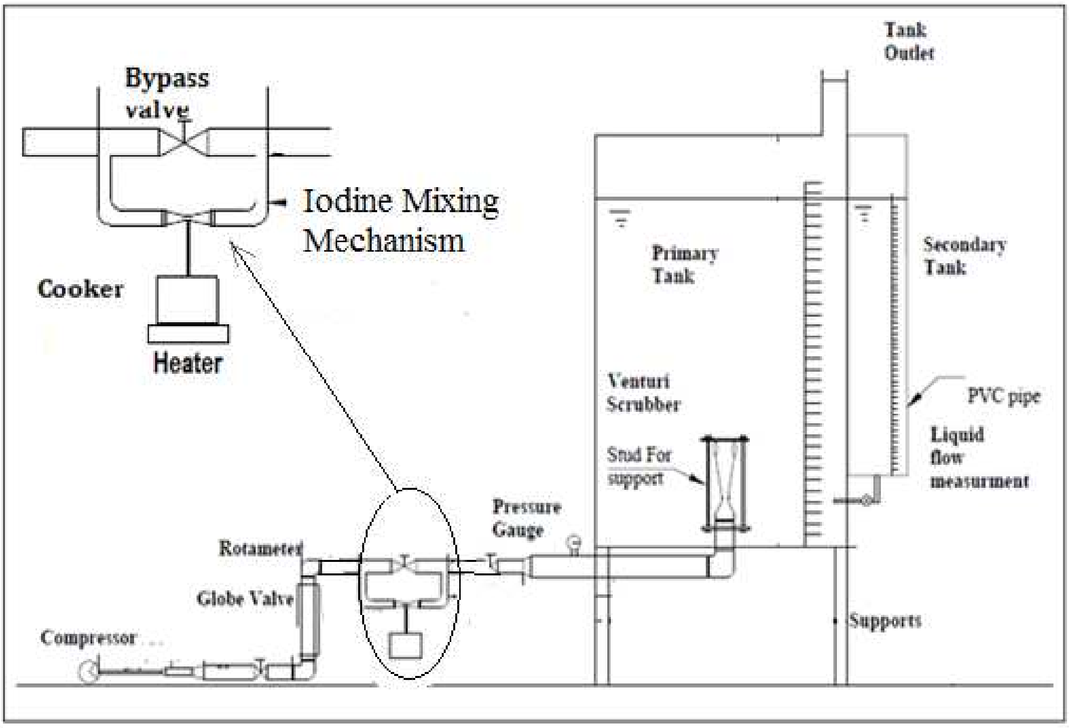

Figure 4: Schematic Diagram of Experimental Facility [18]

Figure 4 depicts schematic diagram of experimental facility; it consists of several apparatuses like primary tank, venturi scrubber, pressure regulator, rotameter, globe valve, suction venturi, secondary tank and pressure gauge. Primary tank of 5 m height having a provision of surplus outlines at six separate positions of tank (1.0 m, 1.5 m, 2.0 m, 2.5 m, 3.0 m and 3.5 m) is used and these surplus outlines are used to collect the surplus of water. A submerged type of venturi is placed in primary tank. Compressed air from compressor is received at appropriate pressure which is retained at essential initial system pressure using air pressure regulating device. Regulator exit pressure is detected within 0.6-1.35 $kgcm^{-2}$. Suction venturi and bypass valve is used for effective mingling of iodine fumes in air. Iodine concentration is measured at entrance and exit of venturi to calculate iodine removal efficiency.

5. EXPERIMENTATION

The heating provision is made for the sublimation of iodine which forms iodine vapours. This arrangement is provided since the iodine fumes can only blend with air and these iodine fumes further sucked using suitable arrangements. Figure5 depicts arrangement for heating of iodine for sublimation, mixing of iodine with air and circulation of contaminated air to venturi. The required pressure for sucking the vapours through suction venturi will be provided by pressurization line. The transparent lines are used to observe suction process during the experimentation. Stream pathway of air flow through suction venturi is diverted by using bypass valve. Figure6 depicts position of bypass valve and suction valve.

Figure 5: Pressure Cooker and Heating System

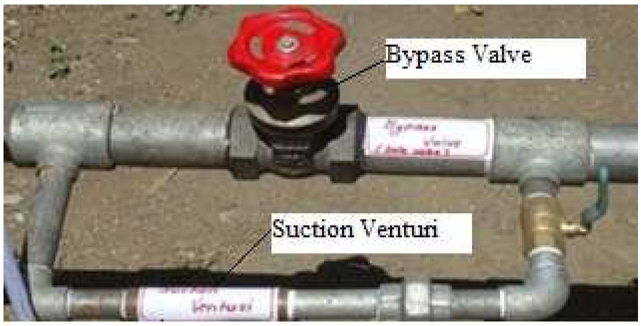

Figure 6: Bypass Valve and Suction Venturi

Iodine vapours are formed by heating known quantity of iodine crystals in pressure cooker till its sublimation temperature. Suction venturi and bypass valve are used to suck iodine vapours. The process is continued for 30 minutes so that sublimated iodine completely transferred into air stream.

Succession of tests are carried out and amount of iodine in scrubbed fluid is calculated by using iodometric titration and these experiments are carried out for different pH of water. For standardization of sodium thiosulphate ($Na_2S_2O_3$) solution, a solution of potassium dichromate ($K_2Cr_2O_7$) of normality 10N is used. Standardization is an example of iodometric titration in which normality of unknown solution is determined by titrating it with the standard solution. When $K_2Cr_2O_7$ is treated with dil. sulphuric acid, nascent oxygen is released with creation of potassium sulphate and chromic sulphate. Further it reacts with KI solution and releases iodine which is then treated with $Na_2S_2O_3$ solution using starch an indicator. Following chemical reactions are taking place during the standardisation.

$$K_2Cr_2O_7 + 4H_2SO_4 \longrightarrow K_2SO_4 + Cr_2(SO_4)_3 + 4H_2O + 3[O]$$

$$6KI + 3H_2SO_4 \longrightarrow 3K_2SO_4 + 6HI$$

$$6HI + 3[O] \longrightarrow 3I_2 + 3H_2O$$

$$2Na_2S_2O_3 + I_2 \longrightarrow Na_2S_4O_6 + 2NaI$$

As soon as the iodine gets mixed with air, air entering into the primary tank becomes impure and some iodine gets transferred into the water. The presence of iodine particles in water is observed with its radish colour inside the tank. Since solubility of iodine in water is very less (about 0.34 gm/L), it was too difficult to make it soluble in water. Sodium hydroxide (NaOH) can be used as alkaline activator and pH of solution varies with temperature [34]. About 9 to 11 gm potassium hydroxide is used to increase the pH of water during experimentation. The iodine mingling is done for variable cases of water: i) 7.0 pH, ii) 8.0 pH, iii) 9.0 pH and iv) 10.0 pH

The determination of iodine in the sample by using iodometric titration is second important part of this experimentation. Sodium thiosulphate solution of 0.001 N is used to titrate first sample (neutral) of water. And fresh starch is used as an indicator to get final reading after completion of process. Similarly, Solution of silver nitrate of 0.005 N is used to titrate second sample of water. And potassium chromate (5%) is used as an indicator to develop final reading after completion of process. The experimental observations and statistics are obtained are used to estimate iodine removal efficiency and check performance of newly fabricated venturi.

6. RESULTS AND DISCUSSIONS

6.1 Iodine Removal Efficiency

After the completion of experiments, it is observed that 43 – 69% iodine particles are removed from the air by using venturi. The observations during the experimentation are mentioned in Table 3. Iodine removal efficiency is calculated for five different iodine inlet concentrations viz 10 g, 20 g, 30 g, 40 g and 50 g with four different pH of Scrubbing fluid (water). The iodine vapours introduced with the gas at entrance of venturi scrubber speeded in convergent section. Throat is comparatively short as a result; collision of iodine vapours with liquid droplets is taking place in diffuser of venturi scrubber. Inertial impaction depends on iodine vapours and droplets and it is responsible for collision of iodine vapours with the liquid drops. Inertial impaction depends on relative velocity between iodine vapours and liquid droplets. Inertial impaction increases with increase in relative velocity between iodine vapours and liquid droplets and with the decrease of diameter of droplet. As gas flow rate increases, diameter of liquid drop decreases and this decrease in diameter increases the surface area which increases more possibility of interaction between iodine vapours and liquid droplets.

Table 3 shows iodine removal efficiency (%) and is calculated by with the help of formula mentioned below:

$$Iodine\ removal\ efficiency\ (\%) = \frac{Quantity\ of\ iodine\ in\ cooker\ before\ start\ of\ experiment}{Total\ quantity\ of\ iodine\ in\ water\ obtained\ by\ iodometric\ titration} \times 100$$

Table 3: Iodine Removal Efficiency of Venturi (Varying pH of water and Iodine Inlet Concentration)

Sl. No.	pH of Scrubbing Fluid	Initial Quantity of Iodine (g)	Total Quantity of Iodine after Completion of Experiment (g)	% of Iodine Removal
1	7.00	10.00	4.36	43.63
2	7.00	20.00	8.85	44.26
3	7.00	30.00	13.66	46.20
4	7.00	40.00	19.55	48.87
5	7.00	50.00	25.16	50.31
6	8.00	10.00	4.43	44.32
7	8.00	20.00	9.17	45.84

8	8.00	30.00	14.09	46.97
9	8.00	40.00	19.69	49.24
10	8.00	50.00	25.39	50.79
11	9.00	10.00	4.99	49.93
12	9.00	20.00	10.19	50.97
13	9.00	30.00	15.81	52.70
14	9.00	40.00	21.85	54.64
15	9.00	50.00	28.44	56.88
16	10.00	10.00	5.747	57.47
17	10.00	20.00	11.84	59.22
18	10.00	30.00	19.00	63.36
19	10.00	40.00	26.44	66.12
20	10.00	50.00	34.90	69.80

The experiments were carried out for varying pH and iodine inlet concentration in submerged condition of venturi. This has been observed from experimentation that iodine vapours are removed effectively from contaminated air by using venturi scrubber. The experimental results are discussed in following subsection:

6.2 pH of Scrubbing Fluid

Figure 7 depicts the iodine removal efficiency of venturi scrubber. Iodine removal efficiency of venturi scrubber increases with increased pH of scrubbing fluid (water). The maximum efficiency of 69.8% is obtained for 50g iodine inlet concentration and 10 pH of scrubbing fluid. It is also experiential that iodine removal efficiency increases with rise in pH of scrubbing fluid for all iodine inlet concentrations. Iodine removal efficiency can be improved by using higher pH of scrubbing liquid since solubility of iodine gets improved at higher pH value. This is because iodine in the water is oxidised to elemental iodine (I_2) in acidic conditions and the solubility of elemental iodine is very less as compared to alkaline conditions. The higher concentration of alkali into water increases pH of water and this alkali is responsible for more solubility of iodine in water.

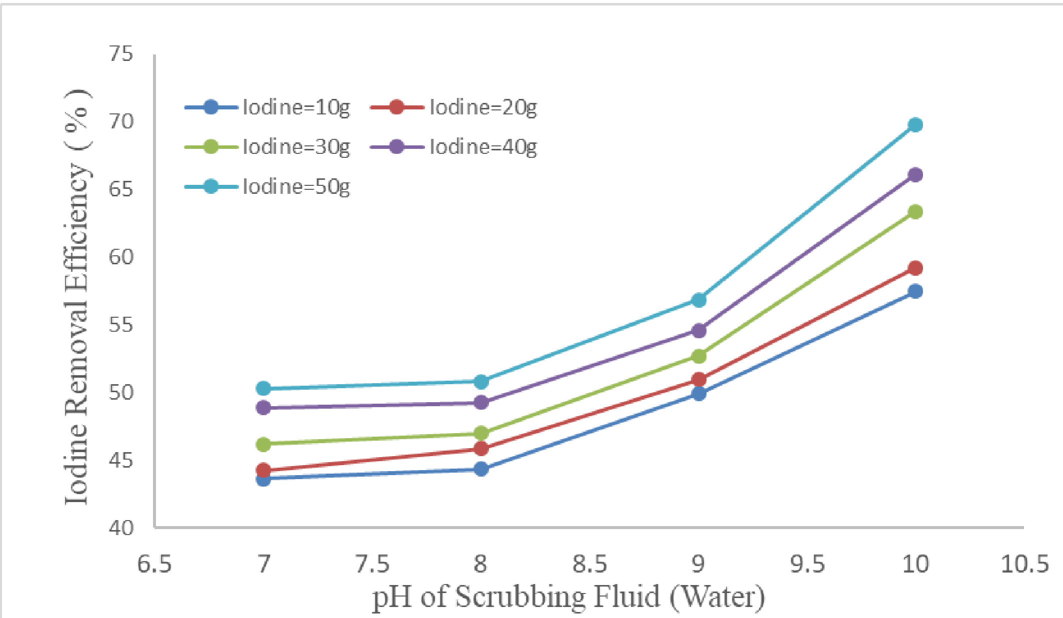

Figure 7: Iodine removal efficiency Vs pH of scrubbing fluid (Water)

6.3 Iodine at Inlet to Venturi

The transfer process of iodine vapours from gas phase into liquid phase is called as absorption process. The concentration differences between gas and liquid phases are responsible for mass transfer phenomenon. The absorption process will be continued till the concentration difference exists between liquid and gas phases. The absorption process can be improved by three ways i) increasing the turbulence or proper mixing of phases, ii) greater contact between phases and iii) increasing the contact time between phases.

Figure 8 depicts iodine removal efficiency of venturi for different inlet concentration of I_2 varies from 10 g to 50 g. The maximum efficiency of 69.8% is obtained for 50 g iodine inlet concentration and 10 pH of scrubbing fluid. It is also observed that iodine removal efficiency increases with an increase in iodine inlet concentrations for all pH of scrubbing fluid and this is due to gas in the form of bubbles rises from water bed.

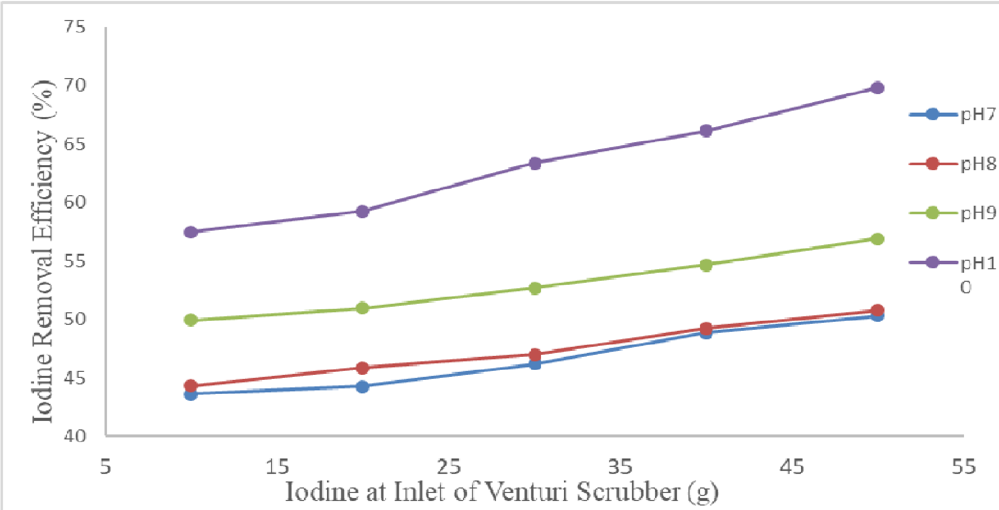

Figure 8: Iodine removal efficiency Vs Iodine at inlet of venturi scrubber

6.4 Liquid to Gas Ratio

In this experiment, primary tank is full with water in such a way that venturi is immersed in water. Volumetric flow of liquid is attuned by regulating the height of liquid above venturi in a primary tank. The iodine vapours interact with the drops initially in venturi and further intermingles with liquids in form of bubbles above venturi scrubber. Iodine removal efficiency increases because of following two reasons (i) increase of liquid flow rate and (ii) interaction of iodine vapours with the surrounding water in primary tank. The volumetric flow rate of liquid increases due to an increase in hydrostatic head in primary tank. This increase in volumetric flow rate of liquid causes increase in L/G ratio which further increases iodine removal efficiency of venturi scrubber.

Figure 9 depicts the variation of L/G ratio with volumetric flow rate of air. It increases with an increase in water content in primary tank and decreases with increase in volumetric flow rate of gas. The L/G ratio is calculated for four different height of water column in primary tank viz. 1.00 m, 1.50 m, 2.00 m, 3.00 m and four different volumetric flow rate of air viz 90 m^3, 100 m^3, 120 m^3 and 150 m^3. The iodine removal efficiency increases with increase in gas mass flow rate and liquid flow rate because as gas mass flow rate increases, more liquid will be entered in the throat of venturi scrubber which results in atomisation of liquid. This atomization of liquid is responsible for the formation of tiny droplets which further collects iodine vapours from the contaminated air.

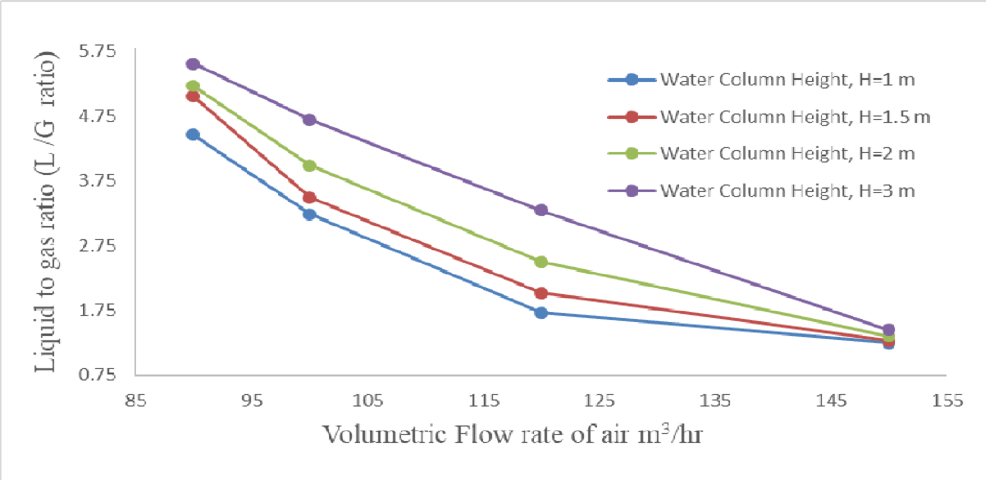

Figure 9: L/G ratio Vs Volumetric Flow Rate

CONCLUSIONS

An investigation of iodine removal efficiency in venturi has been completed experimentally for different pH and iodine inlet concentration. This experimental study basically provided fundamental information for the demonstration effort on forecasting solubility of iodine in water with variable pH. Results of iodine removal efficiency have been calculated with the neutral water (7.0 pH) and water with 8.0 pH, 9.0 pH and 10 pH. The maximum iodine removal efficiency is observed at 10 pH of water. Therefore, pH of scrubbing fluid plays important role for the iodine removal efficiency. It was also detected that the iodine removal efficiency can be enhanced by using greater pH value of fluid since solubility of iodine gets enhanced at greater pH value. The iodine removal efficiency also varies with iodine inlet concentration and it rises with rise in iodine inlet concentration. The L/G ratio rises with a rise in water column in primary tank scrubbing fluid tank) due to hydrostatic pressure of water in primary tank. Iodine removal efficiency rises with rise in L/G ratio because sufficient turbulence occurs at throat of venturi which results in atomization of fluid formation of tiny water droplets which collect iodine vapours by liquid drops and thus iodine removal efficiency increases.

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